Reply to: 3430 Evaluation

Date: October 29, 1980

Subject: Biological Evaluation of Camp Richardson, the Bicycle Trail, the Tahoe Mountain Sale, Fallen Leaf Campground, and the Estates in the Lake Tahoe Basin Management Unit

To: Forest Supervisor, Lake Tahoe Basin Management Unit

Lat 38.93324 Lon -120.04197

INTRODUCTION

On May 7-9, John Wenz and Mike Srago, entomologist and pathologist, respectively, of the FPM Staff met with Jim Schellenger, Laurie Tippon, and Bill Cosale of the Lake Tahoe Basin Management Unit (LTBMU) to evaluate insect and disease related problems in Camp Richardson, along the Bicycle Trail adjacent to Highway 89 and in the Tahoe Mountain Sale area. On June 23-27 John Wenz and Gregg DeNitto (pathologist, FPM Staff) met with Glenn Hampton and Keith Thurkill of the LTBMU. The Fallen Leaf Campground and the Valhalla-Pope-McGonagle Estates were examined for existing and potential pest problems. The objectives of both evaluations were to determine insect and disease conditions, including causes of mortality in each of the areas, and to present management options designed to reduce pest problems and improve the health of the stands.

VEGETATION

Although there is variation among areas, the vegetation can be described as a mixed conifer type, with Jeffrey pine and white fir being the principal components. Incense-cedar and lodgepole pine are the other coniferous species. Hardwoods, such as aspen in Fallen Leaf Campground, are a minor understory component in some areas. The lodge - cabin area of Camp Richardson is almost exclusively a Jeffrey pine overstory with virtually no coniferous regeneration. The Tahoe Mountain Sale area also contains scattered sugar pine. The Pope Estate, in addition to the native flora, has an established arboretum containing both native and exotic species.

INSECT AND DISEASE OBSERVATIONS

Camp Richardson: Enclosed is a map of Camp Richardson showing specific locations of insect and disease situations. In the northwest corner of the lodge - cabin area is an isolated western dwarf mistletoe infection center in Jeffrey pine. This infection center contains six mature Jeffrey pines with 6-class dwarf mistletoe infection ratings ranging from 1 to 6. Starting just east of Sunbeam cabin is another western dwarf mistletoe infection center. This infection center encompasses most of the area between the west boundary fence and the main road to the marina and from Sunbeam cabin to Highway 89. The majority of the Jeffrey pines within this

SSSA

area are infected with dwarf mistletoe. The intensity of the infection within individual trees ranges from light (1-2) to very heavy (5-6). Elytroderma disease is infecting Jeffrey pines north and west of Rolls Royce cabin.

West of Oldsmobile and Lincoln cabins is a Jeffrey pine beetle group kill of about 1/4 acre, involving 21 Jeffrey pines. Four of the trees were killed two or more years ago, 12 were killed last year (brood emerged in 1979), and five were currently infested (foliage green, just beginning to fade). The latter had been attacked in the fall of 1979. The green-infested trees contained larvae and pupae with a few brood adults that should have emerged from July - September 1980. Southwest of Oldsmobile cabin is a small mortality group containing two Jeffrey pines killed last year and one lodgepole pine with a green crown from which the mountain pine beetle had already emerged.

East of the road to the Marina and north of the Term Estate is another Jeffrey pine beetle group kill within a western dwarf mistletoe infection center. Salvage operations had removed many trees from this area, but several green-infested Jeffrey pines remained. Several dead (mountain pine beetle brood emerged) and green-infested lodgepole pines were observed adjacent to the marsh area. Minor feeding damage by the silverspotted tiger moth (Halisidota argentata) was observed on white fir.

In the campground area north of Highway 89 bounded by the Pope Beach Road, the marsh and the Term Estate there is extensive Elytroderma infection. The infection levels within individual trees range from light to heavy. Despite salvage operations, there remain several green, beetle-infested lodgepole and Jeffrey pines. Ips emarginatus was found associated with the Jeffrey pine beetle in a few Jeffrey pines. In the area around campsites D15-16, south to Highway 89, is a narrow band of Jeffrey pine infected with western dwarf mistletoe.

In the campground area south of Highway 89 the Jeffrey pines are infected with Elytroderma. Most of the trees are only lightly to moderately infected, but there are a few scattered pockets of heavy infection. Scattered throughout the area are green-infested Jeffrey pines and white firs. The white firs are infested with the fir engraver; the roundheaded fir borer, Tetropium abietis, was found in the lower bole of a few of the trees infested with fir engraver. Parent adults of the pine engraver beetles, Ips spp., were also found in a Jeffrey pine slash pile. Many incense-cedars in the Trailer/RV Park area are infected with incense-cedar rust (Gymnosporangium libocedri), but this is having minimal impact.

Bicycle Trail: At the end of the four-lane highway, where the bicycle trail begins, there is a large western dwarf mistletoe infection center in the Jeffrey pine. At other points along the trail between the end of the four-lane highway and Pope Beach Road are scattered lodgepole pines and white firs infected with dwarf mistletoe. These are two different species of dwarf mistletoe, neither of which infect other tree species in the area. The white firs are also infected with Cytospora abietis, a fungus that commonly attacks and kills branches of red and white fir infected with dwarf mistletoe. Also scattered along the trail, but particularly in the wildlife sanctuary area, are green lodgepole pines infested with mountain pine beetle.

Along the trail the Jeffrey pine is infected by Elytroderma. From a point approximately five chains south of where the powerline crosses the trail to Pope Beach Road the Jeffrey pine is heavily infected. In the heavily infected area some Jeffrey pines with green crowns are infested with Jeffrey pine beetle and/or the California flatheaded borer, Melanophila californica. The combination of Elytroderma and Jeffrey pine beetle is slowly, but systematically, killing the Jeffrey pines in this area. At the point where the powerline crosses the trail the Jeffrey pines are also infected with western dwarf mistletoe.

The understory in most areas between the end of the four-lane highway and the Pope Beach Road is heavily stocked with white fir and incense-cedar. However, in the area where Elytroderma is the heaviest the understory is sparsely stocked.

From the Kiva Picnic area north to Spring Creek Road Elytroderma infection is very heavy. Pure Jeffrey pine stands are converting to open meadows with little stocking. Mixed species stands of Jeffrey pine, white fir and incense-cedar are losing the Jeffrey pine component and the white fir and incense-cedar are dominating the site.

Two problems exist in the white fir along the bicycle trail. Many have butt and bole scars that are decayed and often infested by insects, such as carpenter ants. Individual white firs are being killed by the fir engraver. This mortality is scattered along the bicycle trail. Evidence of the metallic pitch nodule moth, Petrova metallica, was observed on lodgepole pine and the pine needle scale, Chionaspis pinifoliae, was found on both lodgepole and Jeffrey pines. Both of these insects were present in the other areas evaluated, but are rarely a cause for concern.

Tahoe Mountain Timber Sale: The insect and disease situation in the Tahoe Mountain timber sale area is similar to that described above, with Elytroderma, western dwarf mistletoe and Jeffrey pine beetle affecting the pine. Scattered groups of green infested Jeffrey pines are present. Cytospora canker, the fir engraver and white fir dwarf mistletoe were found associated with white fir.

Fallen Leaf Campground: Attached are maps of the Fallen Leaf Campground showing specific locations of insect and disease situations. The three principal agents attacking Jeffrey pine include Elytroderma disease, western dwarf mistletoe, and Jeffrey pine bark beetle. White fir is being killed or suffering top-kill from attack by fir engraver. Yellow witches broom of fir (Melampsorella caryophyllacearum) was also seen scattered throughout Fallen Leaf, but was not having much impact on the trees.

In Fallen Leaf Campground western dwarf mistletoe is concentrated in three areas: 1) around the pay station and extending south into the area of unit 129; 2) west of the intersection in units 120-123 and 136; and 3) on both sides of the road around units 55 and 56. The first area has a light infestation in the understory and lower crown of the overstory with maximum 6-class dwarf mistletoe ratings of 3. The second area has a heavier infestation involving overstory and understory. Maximum rating in the overstory was 5, and much of the understory will die or be suppressed as a

result of the number of infections. On the west side of the road in the third area the infestation does not extend back into the stand. A moderate infestation exists on the east side around units 55 and 56. The infection level is highest south of unit 56.

Elytroderma disease was heaviest in certain areas of the campground, especially along the margins of meadows. From unit 90 to 97 infection is heavy in most of the Jeffrey pines. Another area of heavy infestation is around the meadows at units 2 and 3. Additional locations where more than three-fourths of each crown is infected by Elytroderma are at units 66, 114, and 200, and west of the pay station.

Scattered mortality, top-kill and patch-kill of white fir by fir engraver occurs in much of the campground. The highest concentration is in the northwest side around units 19 through 26, which is also the area with the highest concentration of white fir.

Locations of Jeffrey pine beetle activity are randomly distributed through the campground. Many of the kills have been salvaged, but green-infested trees are still present around some group kills. The number of trees with successful, active beetle attacks ranges from one to eight depending on the group examined. Larvae, pupae and brood adults were observed and should have emerged from July through September.

Valhalla-Pope-McGonagle Estates: The attached map of the Estates area illustrates the locations of specific insect and disease situations. The problems were similar to those found in Fallen Leaf Campground and include western dwarf mistletoe and Jeffrey pine beetle. Infection by Elytroderma is light in areas where it was found. Many of the Jeffrey pines are free of infection by this fungus.

Along the beach adjacent to the arboretum is a group of large white fir that have been killed by fir engraver. Several other white fir distributed throughout the area around the buildings have also been killed by this insect.

Many of the white firs in the Estates have bole cankers with large open wounds. The causal agent is not known, but the cankers provide an avenue for infection by wood-decay organisms. This is especially important in white fir which has little decay resistance. In a recreation area trunk decay can be especially important in the creation of hazard trees and the possibility of bole failure.

Western dwarf mistletoe exists in some of the pines near the existing bicycle trail. The heaviest infestation is east of the entrance road to the Valhalla Estate. The highest 6-class infection rating in this area is 4, although most of the trees bear some infections. Pine engraver beetles (parent adults) were found in a Jeffrey pine slash pile west of the main house on the Valhalla Estate.

BIOLOGY OF PEST ORGANISMS

Following is a brief summary of the biologies of the most important insects and diseases causing mortality and/or damage in the areas evaluated.

Dwarf Mistletoes. Western (Arceuthobium campylopodum); White Fir (A. abietinum f.sp. concoloris); Lodgepole Pine (A. americanum): Western dwarf mistletoe infects Jeffrey, ponderosa and Coulter pines. White fir is the only host for white fir dwarf mistletoe, just as lodgepole pine dwarf mistletoe infects only lodgepole pine. Other conifers are rarely infected and hardwoods are immune to these pathogens. The pathogens are obligate parasites obtaining their nutrients, minerals and water from the host.

These parasites are dioecious, perennial higher plants that produce seeds as their means of spread. In the fall of the year when the fruit falls from the stem, the seed is ejected upward and outward. The seed (covered with viscin, a sticky, gelatinous substance) adheres to any surface it contacts. When the seed lands in the crown of a susceptible host tree, it adheres to a needle or limb and overwinters. The following spring it germinates and penetrates the limb. For the next 2 to 4 years the plant grows in the tree limb, developing a root-like endophytic system in the inner bark and outer sapwood. It then produces aerial shoots and in another 2 to 4 years produces reproductive structures.

Spread of dwarf mistletoe is limited to the distance traveled by the seed, which from overstory to understory is usually 20 to 60 feet, but may be as much as 100 feet if wind assists the seeds. A rule of thumb is that dwarf mistletoe can spread horizontally to the understory a distance equal to the height of the infection in the overstory tree. Because of the various limits to spread, such as height of the source plant, angle of discharge, wind velocity, stand density, etc., the actual spread rate through an even-aged stand is about 1 to 2 feet per year.

Elytroderma Disease (Elytroderma deformans): In California Elytroderma disease is mainly a disease of Jeffrey and ponderosa pines. It has been found only occasionally on knobcone, lodgepole and pinyon pines. The fungus causes the premature death of 1-year-old needles, and a brooming and deformation of infected twigs and branches. It can cause mortality of infected twigs.

The disease is spread by fungal spores that are released in late summer and early fall from fruiting bodies borne on the infected needles. Under suitable conditions, the spores germinate and infect the current year's needles of susceptible hosts. The fungus then spreads from the needles into the twigs. The following spring the infected needles die and fruiting bodies begin to develop. The infection within the twigs spreads into the growing tips and buds, where it can cause a brooming and deformation of future growth. Broom formation occurs most commonly on vigorous trees.

The effect of the disease depends on the proportion of the host crown that is infected. There is little effect upon the host until more than two-fifths of the twigs are blighted. The disease is most severe on

seedlings, saplings and poles with poor crowns. Although direct killing of mature trees by this disease is infrequent, moderate to severe infection predisposes the host to other diseases and to bark beetle attack.

Jeffrey Pine Beetle (Dendroctonus jeffreyi): This native beetle is considered to be the major insect enemy of Jeffrey pine. Jeffrey pine is the only host in which the beetle is known to reproduce. In the Tahoe area, it has one generation per year. The adults generally fly and attack green trees during the summer (June-August), but can attack into the fall (early October). Successfully attacked trees often do not fade until the spring or early summer following attack. Normal, low-level activity of this beetle is characterized by mortality being concentrated in scattered, slow-growing individual trees or small, 2-to 3-tree groups that have been predisposed by diseases, lightning, drought, overstocking or old age. High-level activity is characterized by mortality occurring in large groups of up to 20 to 30 trees of various ages (8" dbh and greater). Under these circumstances, trees can be successfully attacked regardless of vigor, as the healthy trees may be overcome by large numbers of attacking beetles. In the Basin, the mountain pine beetle, Dendroctonus ponderosae, has a similar one-year life cycle, except that it attacks lodgepole pine.

Fir Engraver (Scolytus ventralis): The fir engraver attacks most true firs from pole size to over-mature in the western United States, including white fir. In contrast to the Jeffrey pine beetle, where successful attacks result in the death of the tree, attack by the fir engraver can result in a) mortality, b) top-kill, or c) patch kill along the bole. In the Tahoe area, it can take from 1 to 2 years to complete a life cycle. Adults fly and attack trees between June and September; larvae, pupae and adults overwinter. Pitch tubes are not formed as with the Jeffrey pine beetle, but attacks are often characterized by boring dust in bark crevices along the trunk and pitch streamers on the mid and upper bole. Trees successfully attacked early in the summer may exhibit fading of the foliage by early fall, but those attacked later in the year will not begin to fade until the following spring/summer. As with the Jeffrey pine beetle, the beetles may already have emerged by the time the tree fades.

PEST-SPECIFIC MANAGEMENT TECHNIQUES

Methods to reduce the impact of individual pests are presented below. These techniques are integrated into overall management options in the section that follows.

A. Dwarf Mistletoe

The long-term effect of dwarf mistletoe in pine is the decadence and possible loss of the host species as a major stand component. A series of actions are possible in recreation areas to reduce the impact and intensity of dwarf mistletoe and to retain the integrity and natural appearance of the stand.

1. Light infestation. The number of potential crop trees remaining in the stand is sufficient to meet minimum stocking levels if dwarf mistletoe suppression by sanitation is done.

a. Thin the infected stand to maintain the vigor of residuals and increase their resistance to bark beetles. Discriminate against trees with the heaviest levels of infection. Consider the removal of pines with 6-class dwarf mistletoe ratings of 5 and 6 because they have a higher probability of being infested by bark beetles and dying within 10 to 15 years. Also, bark beetle-infested trees can serve as foci for group kills.

   Favor non-host species in the selection criteria.

b. Witches brooms in residual trees may be pruned if at least one-third live crown remains after pruning. Removal of witches brooms will maintain tree vigor, but it will not necessarily stop the spread of dwarf mistletoe in the stand.

c. When regenerating openings in the stand, plant non-susceptible species. This will maintain a vegetation cover and reduce dwarf mistletoe spread by breaking up canopy-continuity.

d. Create a buffer strip between treated stands and surrounding infected stands, if needed. If possible, use natural barriers such as roads, streams, change in vegetation type, etc.

e. Conduct post-suppression surveys every two years for six years. Repeat treatment if the objectives are not met.

2. Heavy infestation. The number of potential crop trees remaining in the stand is too low to permit a sanitation project without reducing stocking below minimum acceptable level.

   a. The most effective control method in heavily infested areas is species conversion. This can be done by planting non-susceptible species and the slow removal of susceptible overstory and understory. Once the source of infection is removed, then the susceptible species can be reintroduced. The size of heavily infested areas that were observed in the LTBMU is small. Therefore, this alternative could be effectively used in a few areas with minimal impact on the recreation site. Treatment areas must be isolated from surrounding infected areas by buffer strips.

   b. Generally, retaining old-growth trees is desirable in recreation areas. Diminishing vigor is characteristic of these trees and dwarf mistletoe infection adds stress. It may be possible to retain these trees for a longer period if dwarf mistletoe-caused witches brooms are removed, leaving at least one-third live crown. Infected branches that are not broomed may be retained. However, by following this procedure eradication of the pathogen in the area will not be possible, until the old-growth trees die or are removed.

3. White fir dwarf mistletoe. Immature white fir with light to moderate levels of infection will respond to release. By providing

optimum stocking levels, infected white fir growing on good sites can achieve a rate of height growth greater than the rate of vertical spread of dwarf mistletoe. Released white fir, therefore, will outgrow the dwarf mistletoe infection.

B. Elytroderma Disease

Elytroderma disease can only be managed by species manipulation. High-risk areas should be identified based on present infections. Infections are visible in late spring and early summer when infected, red-brown needles are still present on the trees. High-risk areas should be managed for non-host species, such as white-fir, incense-cedar, and lodgepole pine. The last species is also susceptible, but was not observed to be infected in the Lake Tahoe Basin.

In areas of light to moderate infection, mortality may be reduced by improving tree vigor. This can be done through thinning and reduction of competition. When selecting leave trees, favor non-host species and host species that have the lightest infections.

C. Annosus Root Rot

Although Fomes annosus was not found in any of the areas examined, it is known to be present in the Basin. New infections or spread of the disease occurs primarily by air-borne spores coming in contact with fresh conifer stumps. Thus, not taking preventive action will greatly increase the probability of the disease being introduced into the high-value, high-use areas examined. Once Fomes is established in an area there is no known direct means of control.

To prevent the infestation of recreation areas by this fungus, a control technique is available to the resource manager. When conifers are felled the resulting stump should be treated with dry borax (sodium tetraborate decahydrate). The stump surface should be covered by the chemical, preferably right after falling. Provision for treatment of coniferous stumps is included in the FSM 2305 and 2331.33. The use of borax requires an Environmental Assessment and a Pesticide Use Proposal (FS Form 2100-2).

D. Bark Beetles

Bark beetle management options include: a) direct population reduction, b) individual tree protection, and c) mitigation of predisposing conditions or factors.

a. Direct population reduction. Direct control methods include locating, felling and treating infested trees a) with insecticides; b) by burning; c) by peeling the bark; d) by burying infested material; and e) by removing infested trees from the forest. Most of these methods have been shown to be effective in killing bark beetles, but they have not been demonstrated to reduce bark beetle populations to levels low enough in a given area to reduce tree mortality to an acceptable level. In addition, direct control techniques are considered to have an adverse effect on bark beetle

natural enemies, which play a stabilizing role in the dynamics of bark beetle populations. Other methods, such as the use of behavior-modifying chemicals (e.g. pheromones) to manipulate bark beetle populations, are still in the experimental stage.

b. Individual tree protection. This approach has been developed specifically to prevent/reduce bark beetle-related mortality in situations where tree values are high and often not easily described in traditional dollar values. Under such conditions, relatively expensive, individual tree, prophylatic treatments using insecticides may be warranted. Currently, two chemicals are registered: lindane (products containing 20% lindane concentrate), registered for control of "bark beetles", and Sevimol 4 carbaryl insecticide, registered in California as preventive treatment for pines against the western and mountain pine beetles. Experiments are currently being conducted to evaluate the efficacy of additional materials against the western pine beetle.

There are several factors to consider relative to this approach. First, treating only individual trees does not deal with the underlying factors that predispose trees to bark beetle attack. Second, efficacy depends to a large extent on getting good bole coverage with the spray, which can be very difficult with large trees. Third, no matter how carefully the insecticide is applied there will be a) some drift with a resulting potential effect on non-target organisms not on the treated tree as well as b) potential effects on non-target organisms, including beneficials, on the treated tree. Fourth, it is not yet clear how long a single treatment will remain effective and thus, how frequently re-treatment would be necessary to provide protection. Fifth, to the extent that the treatment would involve people and dollar resources and divert efforts from longer-term preventive action (e.g. vegetation management), overall effects might be negative.

Use of this approach requires careful consideration. One hypothetical situation could be where road or building construction or hazard/salvage tree removal causes damage to high value residual trees, predisposing them to bark beetle attack. Another circumstance might be when trees are under severe stress (drought). To the extent that such predisposition is temporary and will diminish as the tree recovers from the stress, a preventive treatment during the "susceptible" period might be warranted. Although chemicals are registered for this purpose, this approach has not been evaluated over a variety of situations on an operational basis in California.

c. Mitigation of predisposing conditions or factors. Bark beetle problems in California have usually been associated with trees and stands that have been weakened or stressed by some predisposing agent or condition. Given sufficient numbers, bark beetles can successfully attack and kill healthy trees; however, it takes considerably fewer beetles to kill stressed, weakened, less vigorous trees. Relatively few beetles may successfully attack a weakened tree and produce an aggregating pheromone. The pheromone

may attract sufficient numbers of additional beetles to the area to overcome nearby healthy trees. Predisposing factors include fire, mechanical injury from logging or road and building construction, mechanical injury to trees near campsites and campground facilities, compaction, drought, photochemical air pollution, root disease, dwarf mistletoe, Elytroderma, overstocking and poor site conditions.

Important among approaches to prevent or reduce predisposing factors is vegetation management. This includes silvicultural options to control stocking levels, species composition, and regeneration. Such practices are compatible with measures recommended to manage diseases such as dwarf mistletoes. Conducting operations, such as logging, in a skilled and careful manner is another critical element in the overall preventive approach. Managing for healthy, vigorous stands should reduce the impacts of non-manageable factors like drought. In some situations, the means of mitigating predisposing conditions, such as thinning, may conflict with other resource objectives or political realities. However, bark beetle-related losses cannot be significantly reduced in the long run without alleviating the contributing factors.

MANAGEMENT OPTIONS

The following management options are applicable to all of the areas examined. The specific means of applying the options may vary for different sites. Also, priorities may dictate which areas, if any, are treated before others.

A. No Action

Recent catostrophic losses can be attributed, in part, to the drought; and future losses could be at lower levels, even without management activities, as long as adequate moisture is available. However, overstocking, dwarf mistletoe and Elytroderma disease remain as factors predisposing trees to bark beetle attack. If no management action is taken, continued mortality can be expected that may interfere with the attainment of goals and objectives.

B. Salvage

This option will remove dead and dying trees (marking crews should be trained to recognize green, unfaded, but beetle-infested trees), realize some economic value from the killed timber, help support local logging interests and/or provide firewood. It should engender little local opposition because uninfested living trees are not cut and it basically allows bark beetles to kill trees in a "natural" manner which is consistent with some "publics" perception of management objectives in recreation areas.

Under this option mortality can be expected to continue, necessitating repeated salvage, until most of the susceptible trees have been

killed. In addition, some nearby healthy trees may be killed. The pattern of tree removal will not be planned, and spacing of the residual trees will probably not be optimal-as typified, for example, by the current situation in the campground area of Camp Richardson adjacent to the Pope Beach access road. This option alone does not actively mitigate the identified predisposing factors and does not provide for regeneration.

C. Thin

In addition to removing dead and dying trees, green trees would be removed to alleviate one of the more important predisposing factors -- overstocking. Stocking densities should be adjusted by aggregate rather than on a stand basis. It is suggested that stocking levels in predominantly pine areas be reduced to about 175 sq. ft./ac, depending on age. Mixed species aggregations with a high proportion of fir could be thinned to a somewhat higher reserve basal area. At the same time, other factors, such as visual quality or tree location, may dictate leaving higher residual basal areas in specific aggregations at the expense of higher risk of beetle attack. Thinning may also enhance natural regeneration.

The following criteria should be considered when trees are selected for removal:

1. hazard trees;

2. trees with dwarf mistletoe, especially those with ratings of 5 or 6;

3. trees with more than 2/5 of the twigs blighted by Elytroderma;

4. trees with thin, poorly-formed crowns or less than 30% live crown ratio;

5. white-fir with pitch streamers on main bole;

6. trees obviously suppressed.

Many sites throughout the evaluated areas are suitable for this option. In the lodge-cabin area of Camp Richardson aggregations with a basal area of 450 sq. ft./ac. occur. Thinning such aggregations would be of considerable benefit to the residual trees. A primary selection criterion would be dwarf mistletoe which is heavy east of Aristo cabin and north of Golden Shell and Ford cabins. Broom pruning could also be beneficial to some trees.

Parts of the Estates, the eastern end of the Bicycle Trail up to the Pope Beach access road, the western end of the Trail beyond Taylor Creek and parts of both the campground and trailer park sections of Camp Richardson are also overstocked, but have a greater species and age class diversity. Selective thinning in these areas could enhance stand vigor and at the same time maintain or increase species diversity and age class distribution. Stand diversity should reduce

chances of catastropic losses, which often result in single species situations like those in the lodge-cabin area of Camp Richardson. Selective thinning on an aggregation by aggregation basis is also appropriate for the Tahoe Mt. Sale area where a variety of conditions also exist.

In Fallen Leaf Campground several areas can serve as examples of the applicability of thinning. Around campsite 100 is a dense stand of overstory Jeffrey pine and of understory white fir. A light, selective thinning of undesirable individuals would improve the vigor of residual trees and release some of the white fir. This action would provide a more diverse, mixed species stand that would be less susceptible to insect and disease losses.

The vegetation around campsites 1 and 2 consists of a dense overstory of Jeffrey pine with a minor understory component of white fir, incense-cedar, and Jeffrey pine. Some of the Jeffrey pine are infected by dwarf mistletoe and Elytroderma. Bark beetles have been active in the aggregation, killing a group of Jeffrey pine between the two sites. Reducing the stocking level in this aggregate would probably reduce future bark beetle-caused mortality.

In addition, the amount and impact of the two disease organisms could be reduced by proper selection of trees for removal. In areas where western dwarf mistletoe is a problem, pruning of witches brooms on residual trees may be considered in conjunction with thinning. Broom pruning should only be done if an active dwarf mistletoe suppression effort is undertaken.

An area where this may be feasible is around campsites 118-123. Specific guidelines can be found in the section on dwarf mistletoe management techniques (p. 6-7).

During any salvage or thinning activity the residual trees, particularly firs, must be protected from damage. Considerable wounding of residual trees was observed in salvage areas along the Bicycle Trail. Special care must be taken during falling and skidding to avoid mechanical damage. Use of machinery around trees should be minimized and restricted to established roads.

No significant pine engraver beetle problems in slash were observed, indicating good slash disposal procedures during salvage operations. If thinning of green trees is done, good slash disposal will be more critical due to the increase in potential pine engraver beetle habitat in green slash. Slash 3 inches in diameter and greater with bark 1 inch thick and less are particularly conducive to population build-up. Thinning in late summer or fall (September - November) is preferential from the standpoint of preventing pine engraver problems, in that colder weather slows brood development and causes some mortality to overwintering larvae and pupae.

D. Regenerate

Because of the pressures impacting these areas, artificial regeneration may be necessary to maintain an adequate cover of diverse

species. This is particularly evident in the lodge-cabin area of Camp Richardson. Various species could be planted depending on the specific situation, including Jeffrey pine, white fir, incense-cedar, and lodgepole pine. Consideration should also be given to planting native shrubs and hardwoods where appropriate to provide variety and screening between units.

Planting of sapling-sized trees rather than seedlings may reduce the time needed for the trees to reach replacement size. The larger trees may also be less prone to people damage and could be screened. Probability of survival and subsequent establishment would be increased by summer irrigation and perhaps some fertilization.

In areas where dwarf mistletoe or Elytroderma are a problem, such as at campsites 1 and 2 in Fallen Leaf Campground, non-susceptible species should be favored. Complete discrimination against host species may not be necessary, but the objective should be to reduce their dominance in the stand.

If an active regeneration plan is implemented, the timing and frequency of the thinnings discussed in option (C) above should be considered. If extensive thinning occurs after planting, survival and establishment of the regeneration could be adversely affected. Thinning prior to planting should reduce the subsequent need to salvage and would allow for the openings created to be planted (where appropriate) in a timely manner. All dense aggregations would not have to be thinned at the same time, but could be cut in stages; this would allow for some flexibility in scheduling regeneration activities. Depending on establishment success and subsequent growth of the regeneration, future thinnings may have to be considered. Such a regeneration effort of this type will require intensive inputs of time, effort and dollars to be successful. However, a combination of options (C) and (D) should reduce tree mortality rates through mitigation of the underlying factors and, at the same time, provide for adequate vegetative cover in the future.

E. Hazardous Tree Reduction

Hazardous tree identification and removal is necessary in all recreation areas to safeguard people's lives and property. A hazardous tree safety program first requires a detection survey to identify hazardous tree situations. This survey should be done at least annually by individuals trained in the recognition of hazardous trees. Following detection, efforts should be made to remove hazardous trees as quickly as possible. Permanent records of survey results and actions taken should be maintained. In addition to hazardous tree removal, attempts to minimize formation of hazardous trees is necessary. This can include protecting residual trees during thinnings, consideration of potentially hazardous trees during placement of permanent structures, and education of public users to reduce their impact. This "option" is not actually an alternative to any of the four preceding options, but should be included with whichever one is selected.

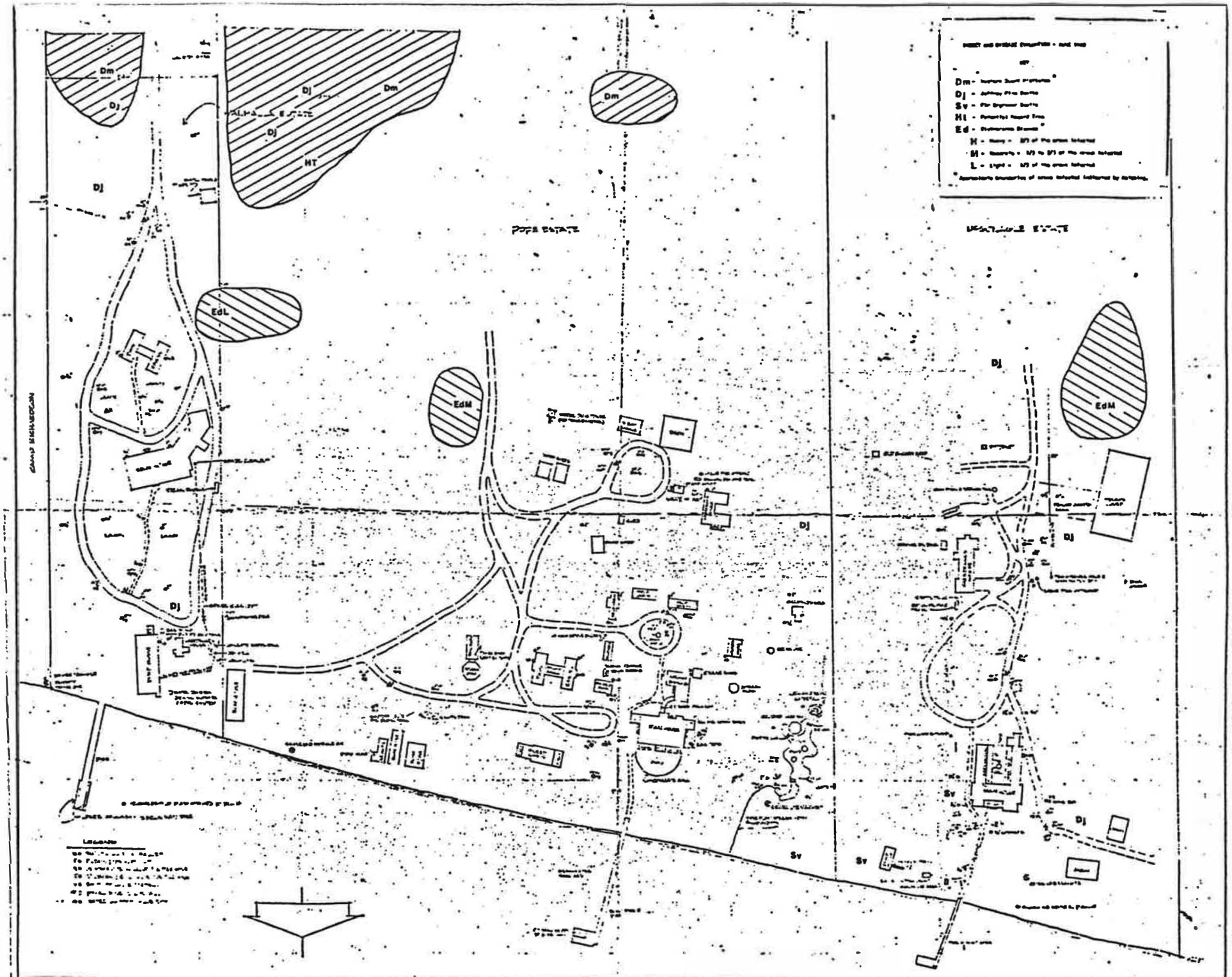
SUMMARY

From the standpoint of insect and disease problems, two basic courses of action exist; live with the losses, as described in options A, B and E, or take positive action to mitigate the predisposing conditions, reduce subsequent mortality and provide for healthy, vigorous stands in the future (options C and D but not excluding B and E). Implementation of the options involving vegetation management will have potential impacts on different resource management objectives and may well result in opposition from segments of the public and other agencies. Should one or more of these options be selected, it is suggested that an interdisciplinary approach be used. Silviculturists, timber managers, recreation specialists and landscape architects, in addition to entomologists and pathologists, should be involved from the planning stages through on-the-ground development of management prescriptions for specific vegetative aggregations. Fish and wildlife, soils and water quality specialists may also have input. Both entomologists and pathologists would be available, as appropriate, to participate in activities to inform public and other agencies of planned actions, ranging from formal meetings to camp fire programs.

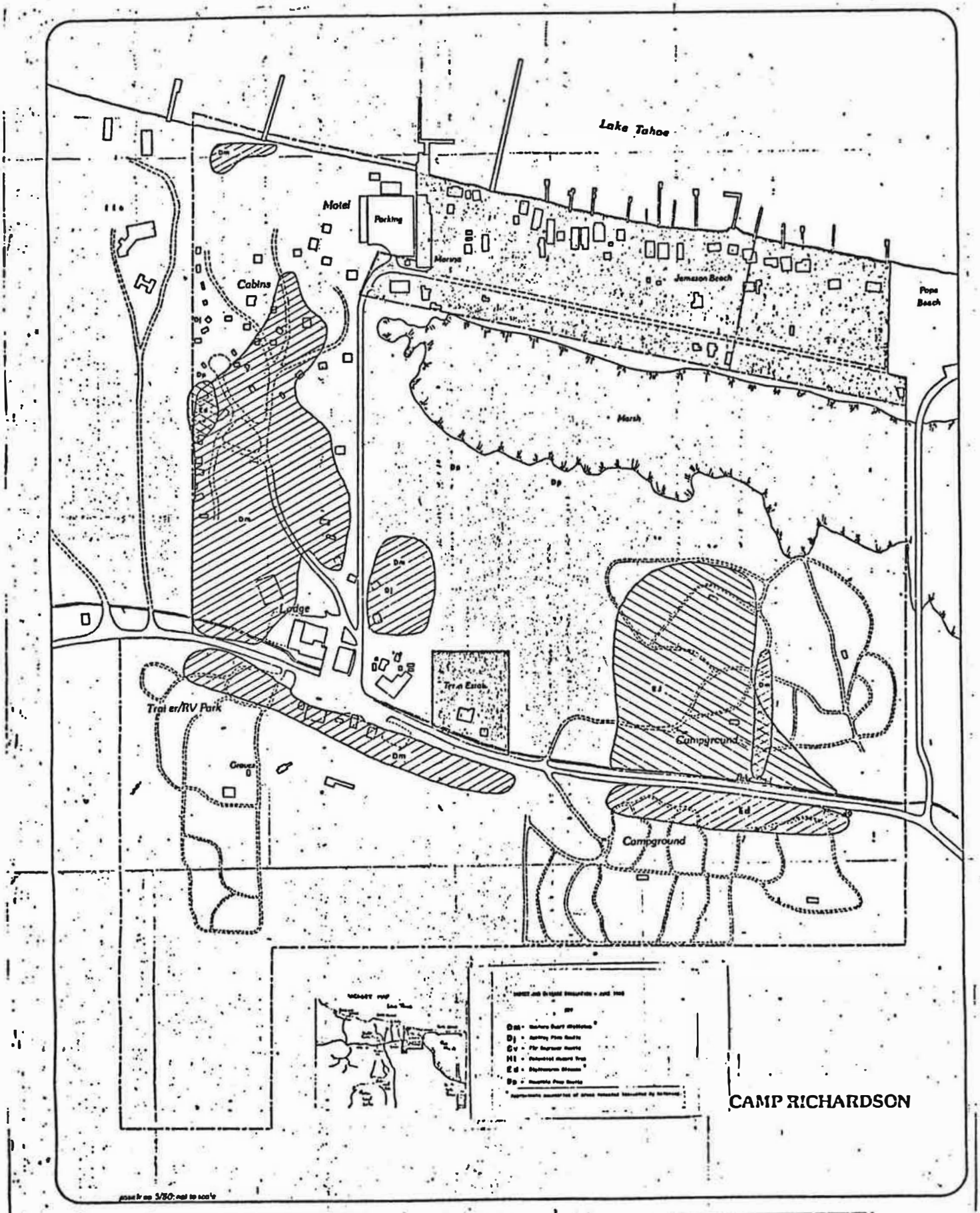
If you have questions or require clarification concerning this evaluation, don't hesitate to contact me or my Staff at (415) 556-6520.

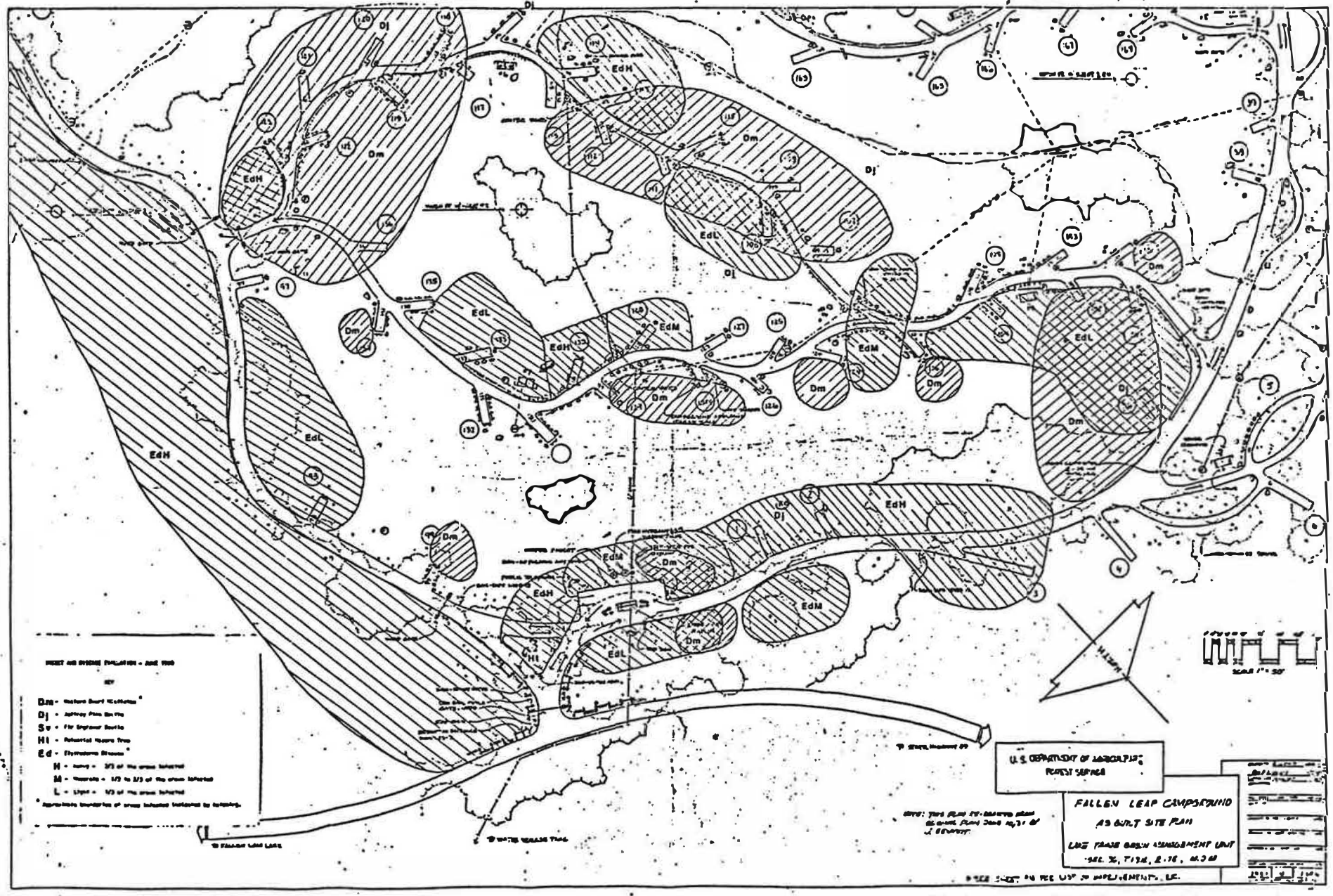
Wilfred L. Freeman Jr.

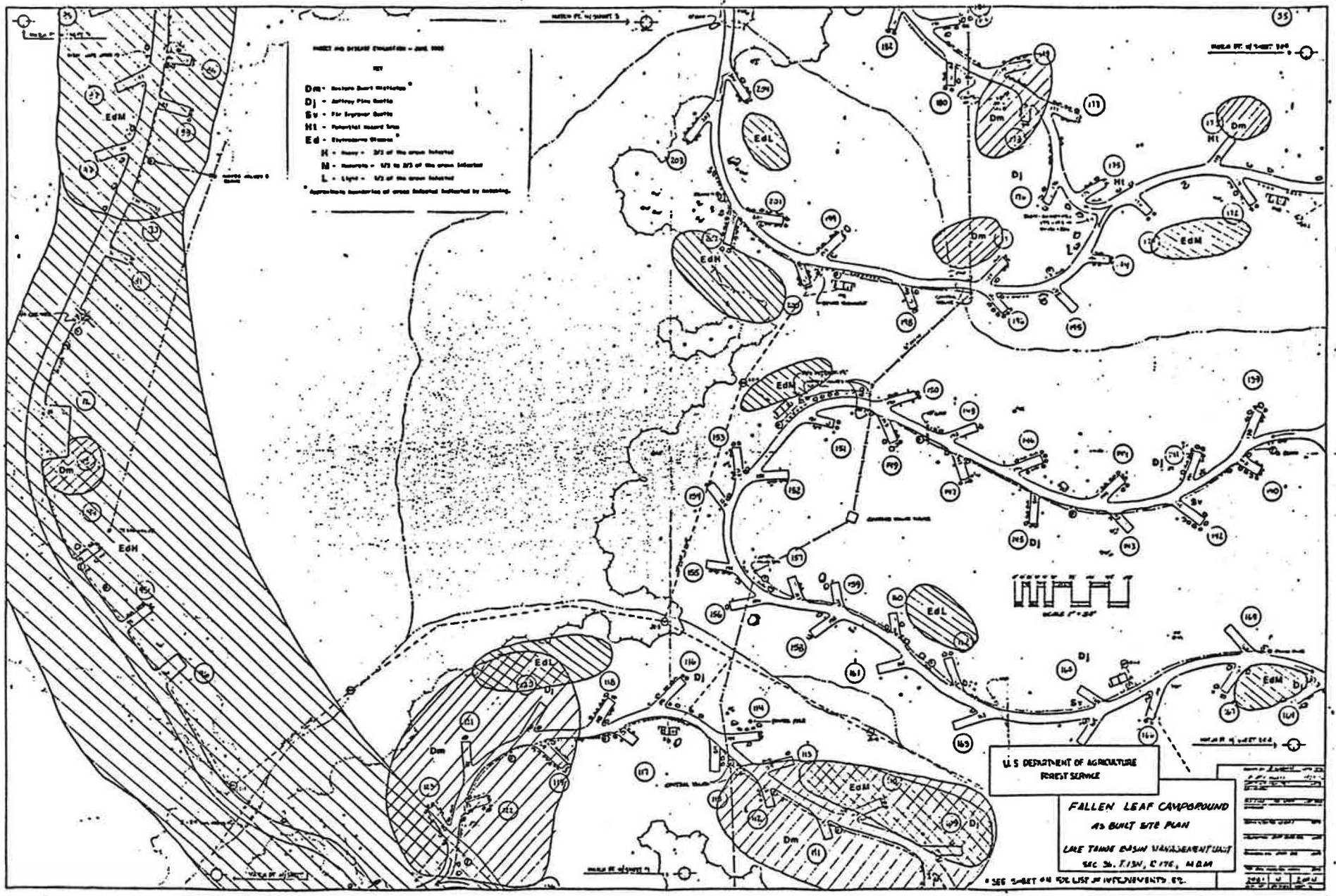
WILFRED L. FREEMAN, JR., Director
Forest Pest Management

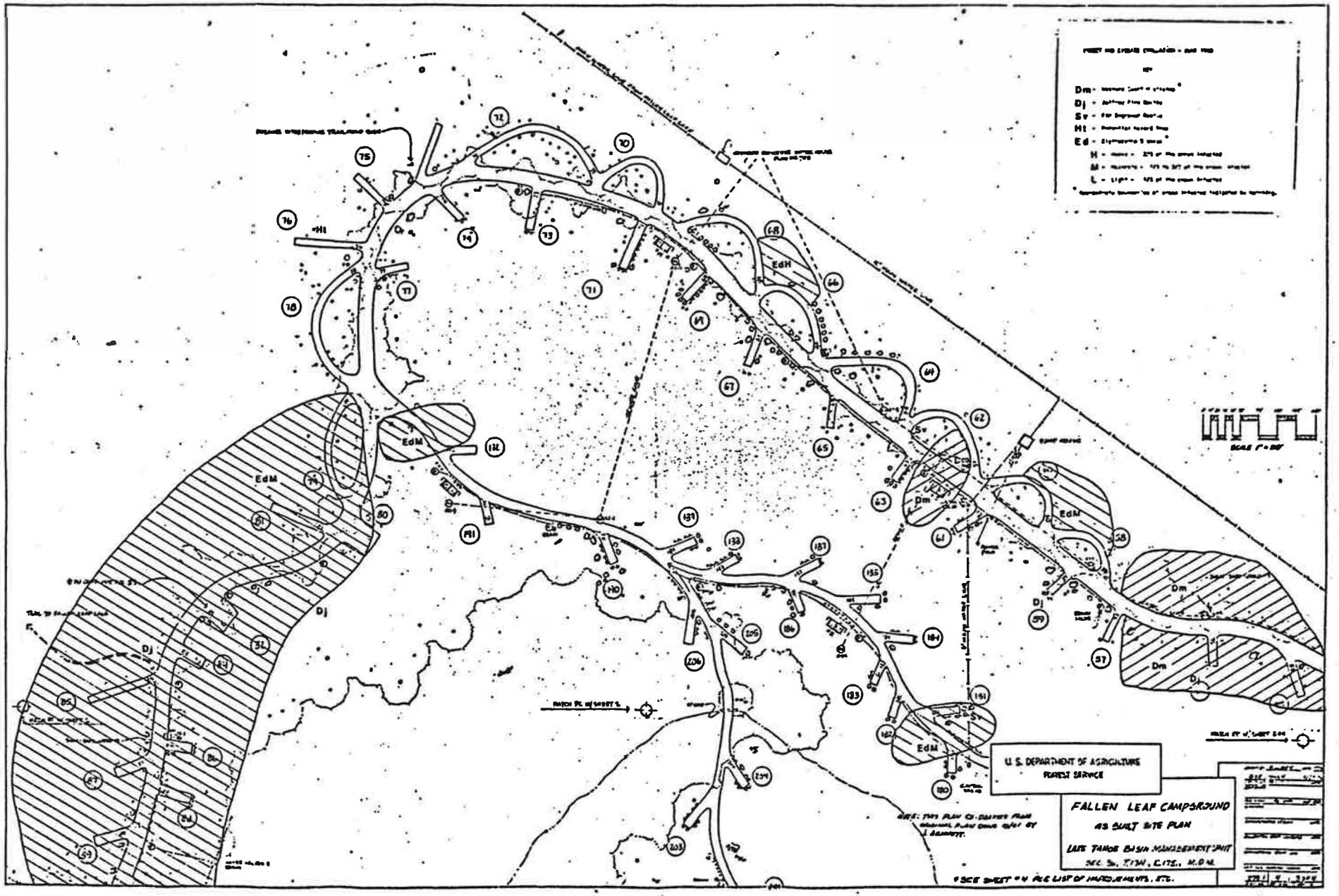


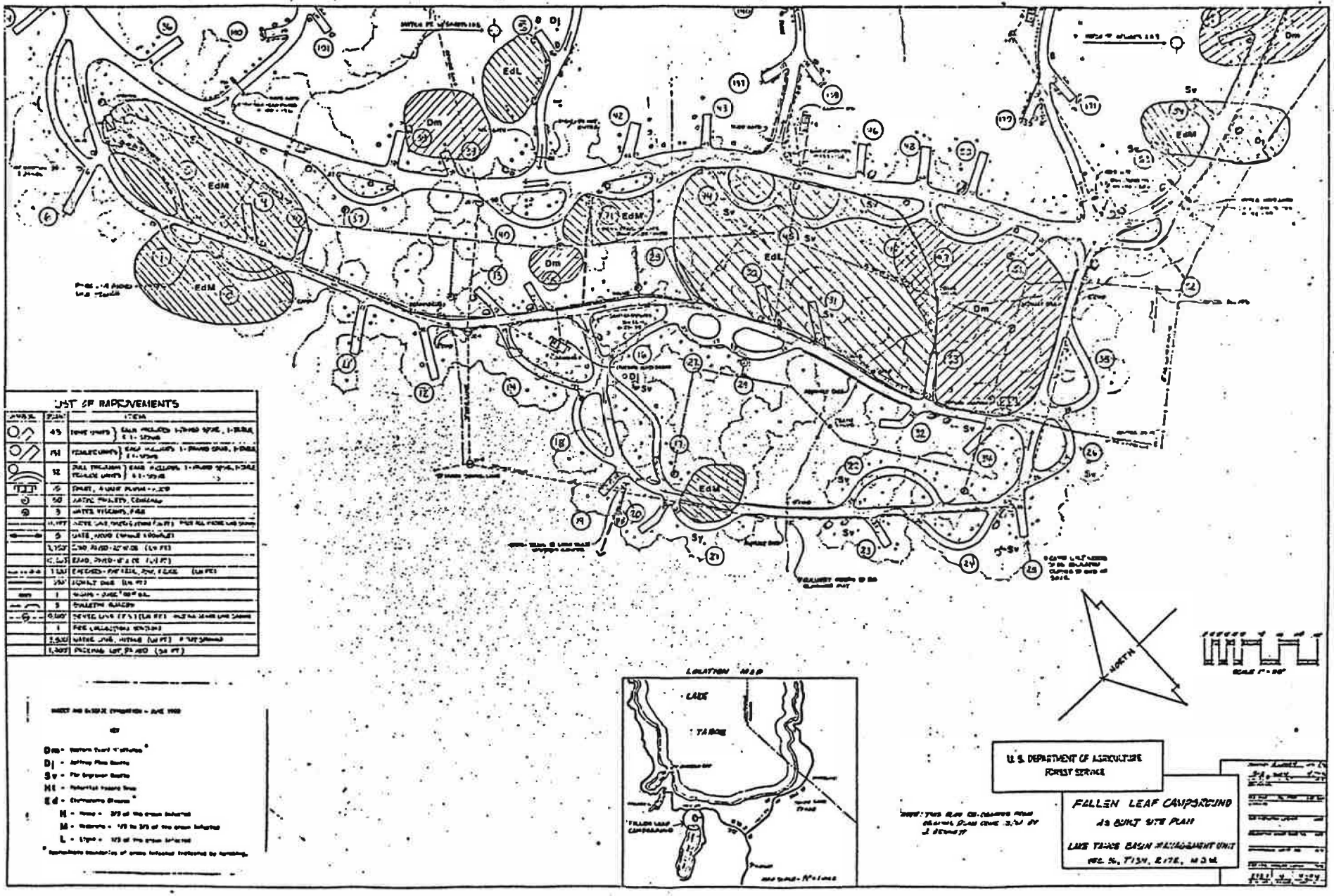
VAHALLA - POPE - MCGONAGLE ESTATES


Lake Tahoe
Motel
Parking
Marina
Cabins
Jameson Beach
Pope Beach
Marsh
Lodge
Trailer/RV Park
Groups
Campground
Campground
CAMP RICHARDSON


Dj
EdH
Dm
EdL
EdM
Dm
Dj
EdH
Dm
EdL
EdM
Dm
Dm
EdL
Dm
Dj
EdH
EdM
EdH
Dm
EdM
EdL
Dm
Hl
EdL
Dm
Dm
EdH
Dj
EdH
EdL
Dm
EdM
Dm
Dm
EdL
Dm
Dm
EdH
EdL
Dm
Dm
Dm
EdH
EdM
Dm
EdH
EdL
Hl
Dm - Mature Dwarf Mistletoe
Dj - Jeffrey Pine Beetle
Sw - Fir Engraver Beetle
Hl - Potential Hazard Tree
Ed - Flatheaded Borers
H - Heavy - 2/3 of the crown infected
M - Moderate - 1/3 to 2/3 of the crown infected
L - Light - 1/3 of the crown infected
NORTH
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FALLEN LEAF CAMPGROUND
AS BUILT SITE PLAN
LAKE TAHOE BASIN MANAGEMENT UNIT
SEC. 36, T13N, R.16E., M.D.M.


Dm - Jeffrey Pine Series
Dj - Jeffrey Pine Series
Sv - Fir Dryopsis Series
Ht - Potential Hazard Tree
Ed - Dystrochrepts Dystrics
H - Heavy - 2/3 of the area Infected
M - Moderate - 1/3 to 2/3 of the area Infected
L - Light - 1/3 of the area Infected
* Approximate boundaries of areas Infected Indicated by Hatching.
EdM
EdH
EdL
Dm
Dj
Sv
Ht
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FALLEN LEAF CAMPGROUND
AS BUILT SITE PLAN
LAKE TAHOE BASIN MANAGEMENT UNIT
SEC 36, T13N, R17E, MDM
* SEE SHEET ON FOR LIST OF IMPROVEMENTS ETC.


Dm
Dj
Sv
Ht
Ed
H
M
L
EdM
EdH
Dj
Dm
Sv
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FALLEN LEAF CAMPGROUND
AS BUILT SITE PLAN
LAKE TAHOE BASIN MANAGEMENT UNIT
SCALE 1" = 100'


LIST OF IMPROVEMENTS
ITEM
Dm - Meadow Land Complex
Dj - Jeffrey Pine Stands
Sv - Tie Sagebrush Stands
Mt - Mountain Meadow Stands
Ed - Elevation Classes
H - Above - 30% of the areas Inventoried
M - Moderate - 10% to 30% of the areas Inventoried
L - Under - 10% of the areas Inventoried
LOCATION MAP
LAKE
TAHOE
FALLEN LEAF CAMPGROUND
NORTH
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FALLEN LEAF CAMPGROUND
AS BUILT SITE PLAN
LAKE TAHOE BASIN MANAGEMENT UNIT